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ancy as another proof of three views elsewhere urged by us; 1. That a *very large* number of specimens especially of fœtal brains, must be carefully studied. 2. That the results must be checked by an equally careful comparison between the *two halves of the same brain.* 3. That the existing disagreement is likely to persist for a long time unless we discard the human brain for the simpler brains of the lower monkeys, the lemurs and *carnivora*, using large numbers of brains of *nearly allied* species. But the foregoing considerations do not hinder our acknowledgment that the present work is a real boon to anatomical science; since it for the first time renders it possible, for the reader of English only, to ascertain what has been done in cerebral topography; the figures are clear, the nomenclature uniform, and a full synonymy is prefixed to the description of each fissure and fold.

The fissures, are, correctly as we think, stated to be the "more important," but upon what ground is not indicated; and there is given a brief account of the formation of the Sylvian fissure, as differing from all others: a point which has been in part confirmed by our own observations upon the brains of young animals.

We are now inclined to return to the ancient belief that each cerebral hemisphere acts as a unit and with more or less vigor according to the number and depth of the fissures; but Ecker vigorously repudiates this idea, holding that it "consists of a multitude of organs each of which subserves definite intellectual processes." But this opinion, while according with the original idea of phrenology, by no means indicates our author's estimate of the present "professors" of that "science" to whom, together with the rest of this admirable little work, we cordially recommend the following passage (p. 9). "The travelling phrenologists, who wander around with plaster heads of Schiller, Napoleon and some celebrated rascals, and cipher out a character from a number of bumps on the skull, are well known. Few of them have ever seen a brain."—BURT G. WILDER.

INFUSORIAL LIFE.*—Under this title Mr. W. H. Dallinger and Dr. J. Drysdale publish, jointly, in the August No. of the "Monthly Microscopical Journal," an article of extreme interest as a natural history contribution, and of revolutionary importance in respect to the prevalent methods of investigating questions of "spontaneous generation." Dissatisfied, as most thinkers are, with the vague and uncertain methods and conclusions of heated infusions and sealed flasks, the authors turned for an answer to the life history of the individual monads, and fortunately succeeded in obtaining the history of a species which might easily have been described as a group of species or quoted as an organism of spontaneous origin.

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* Researches on the Life History of a Cercomonad: a Lesson in Biogenesis.

The necessity for a change in the methods of study in biogenesis is well stated in their words, as follows:—"The question as to whether vital forms of the lowliest and minutest kind may have their origin in a new, and as yet unexplained, arrangement of non-vital material, is one that can never find a legitimate and final reply in the class of experiments employed to test it within the last thirty years. A careful student of the literature of the subject will see that the *results* obtained by the same and different experimenters, with similar infusions and solutions, are so uncertain, and often contradictory, as to leave the whole question open to bias; and an almost equal array of so-called 'experimental facts' from nearly equally trustworthy observers, may be quoted on either side. This may be all pleasant enough in a 'wordy war,' but it does not even approximate to a decision of the issue, and points to insufficiency in the experiments employed. The appearance or non-appearance of organic forms in certain infusions placed in sealed flasks or tubes, or otherwise conditioned, is held to be decisive of their production *de novo* or otherwise; but in point of fact we know *nothing*—absolutely nothing—of the life history of the greater number of the forms produced. To attempt to decide, therefore, from the experiments as yet published, that their production in gross masses in inorganic infusions proves that inorganic elements produced them, may be to beg the whole question. Inferring from what we *know* of nature's modes of reproduction, we have a right to expect, not a *de novo* production, but a production from genetic elements. But when we remember the relation in size, throughout nature, between the ova and spermatozoa and the organism producing them, the fact that no such elements are visible (if they exist) in Bacteria or monads is probably a mere necessity of our present instrumental power. At least this is inevitable, that before we can be scientifically certain that these lowly forms do or do not originate in non-vital elements, we ought to know their life-history; and if this be desirable in the question of abiogenesis, it must be absolutely essential before we can even approach that of heterogenesis. We must patiently follow them without a break in observation, through all their changes, and then, by repeating these observations, decide on the stability or otherwise of the form. For some years our attention has been individually directed to this subject; and three years since the advisability of combined work commended itself to us. For work of this kind to be effective, we believe there must be more than one observer, in order that the observations may be unbroken as far as possible, and also to secure a mutual as well as a double confirmation."

With Ross' medium powers, and Powell and Lealand's high ones, the authors commenced the study of an undescribed monad which sometimes occurs abundantly in water in which a cod's head has been macerated. The drop of infusion was so arranged that it could be preserved in the focus of the highest powers, and the organisms inhabiting it maintained alive and healthy, and under continuous observation for an indefinite length of time.

The cercomonad subjected to study was a small oval body with two actively moving flagella at one end. This was the familiar, mature form, and the one which, alone, according to the usage of the students of Infusoria, would be considered characteristic of the species. Other forms however were observed, differing in size and shape and with one flagellum at each end, or amœboid with or without flagella, or cyst-like and smooth and globular; forms each of which might easily be regarded as a distinct species or possibly as a capricious variety, but which were tracked through a series of transitions, the recurrence of which was repeatedly observed and was found to be unvarying and to be a portion of the life history of the same individual. The mature form with oval body and two flagella at one end, after moving about with great activity for a period of time which in the observed cases was about forty minutes, became squarer or more elongated, and somewhat dumb-bell shaped by a sudden constriction of the sarcode. At this stage the body is furnished with one flagellum at each end, which lashes with great force. The constricted portion becomes narrowed more and more by stretching until so attenuated as to equal only the flagella in thickness, when it parts in the middle, leaving two separate bodies each furnished with a flagellum at each end.

This multiplication by fission, in an average of forty cases, was completed in four minutes and forty seconds, and continued to be repeated without variation during from two to eight days.

After this period the organism gradually assumes an amœboid form by pouring out a delicate sarcode, and moves only by pseudopodia although the flagella are still present and somewhat active. In the course of seven hours, there were several of these amœboid forms in the field, each enclosing or enveloping a flagellated body. Finally two of these approached each other until they touched, and rapid blending of the sarcode took place, the flagella disappeared, the bodies came in contact with each other and rapidly coalesced, and the common body thus formed increased in size until it was no longer enveloped in the delicate sarcode, but became a mere, smooth, globular cyst with a distinct integument which afterwards became thin, burst, and discharged a viscid mass of oily looking matter. Under the power employed, Powell and Lealand $\frac{1}{50}$ and A ocular (× 2500), this presented, when somewhat dispersed, a minutely granulated appearance. By adding an eight inch drawtube and B ocular, it became certain that this consisted of a densely packed mass of inconceivably small granules. The observers believe that they should have wholly failed to see these sporules but for their enormous aggregation and motion in a mass, and that "*with the* $\frac{1}{25}$ *the most accurate observer could not have discovered their presence if he had not previously seen them with the* $\frac{1}{50}$."

The development of these granules was now watched with the greatest care. In six hours they had increased to a decidedly perceptible degree, though still far smaller than the minute and familiar *Bacterium termo* of Cohn; an hour or two later they began to reassume an oval shape; in nine hours from the first they had become rather larger than *B. termo* and had become flagellate and begun to move freely, the bodies became vacuolate, and in something less than twelve hours the normal parent form was assumed. This history was traced carefully and repeatedly, and with unvarying results.

The effects of heat and dessication were also tried; and it was found that although drying slowly upon a glass slide and exposure to a dry heat of 121° C. entirely destroyed all the adult forms, yet, after moistening again with distilled water and watching the field for some hours, growing points were in some instances discovered exactly resembling an early stage of the developing sporules, which points matured into the flagellate state. Farther experiments demonstrated that a heat, without dryness, of 66° C. destroys all the adult forms, while young monads appear and develop in an infusion which has been heated to 127° C., suggesting that the *sporules are uninjured by a temperature which is destructive to the adult.*

After this history, whose importance, if verified by subsequent observation, can scarcely be over-estimated, a history of a monad multiplying by subdivision, reproducing by conjugation (a true sexual reproduction of an extremely simple type), and actually seen to develop from sporules invisible under the powers usually employed in such investigations, and indestructible by heat which is fatal to the adult forms, it seems almost a waste of time to read of experiments with boiled infusions in sealed flasks, and we are rather inclined to wait patiently until Powell and Lealand or Tolles, or some one else, shall give us a lens capable of reading the life-history, whatever it may be, of Bacteria and Vibriones.— R. H. W.

BOTANY.

PERFORATION OF GERARDIA PEDICULARIA BY BEES.— I have always been much interested in the pretty genus Gerardia, largely represented in the vicinity of Providence, R. I. In the summer of 1871, while sitting amidst a dense growth of *G. pedicularia*, I noticed that all the humble-bees which visited the flowers alighted on the outside near the base of the corolla. I could not account for so singular an action, as the aperture to each bell was so wide. I found upon examination that the corolla in each case was pierced on the upper side near the junction with the calyx. I sent a note in regard to the matter to W. H. Leggett, Esq., of New York, and it appeared in the "Bulletin of the Torrey Club." The editor remarked that it was the first case, in his knowledge, of our native flowers being slit in this manner by visiting insects.

Not satisfied with what I then saw, I have watched the plants again this year with much attention, often sitting among them for an hour or more with the bees buzzing about my head. I should say that they were all humble bees, and I have seen but one of them approach the natural opening of the flowers. This was a much larger bee than any of the others. None of them had